Phy 113 – November 20, 2012

- Exam 3 – Dec. 4, 2012
  8 am Hubbell Audit.
- Much material – will send out email shortly w/ Details of Material coverage

Happy Thanksgiving!

Fluids

yes, they can be fun if you've not already Discovered that

Statics

Specific gravity $\equiv \rho_{material} / \rho_{H_2O \text{ at } 4°c}$

Pressure $\equiv$ Force/Area $\underbrace{N/m^2, \text{Pascal}}_{\text{in MKS}}$, torr, Atm

Pascal's law

French
1623–1662

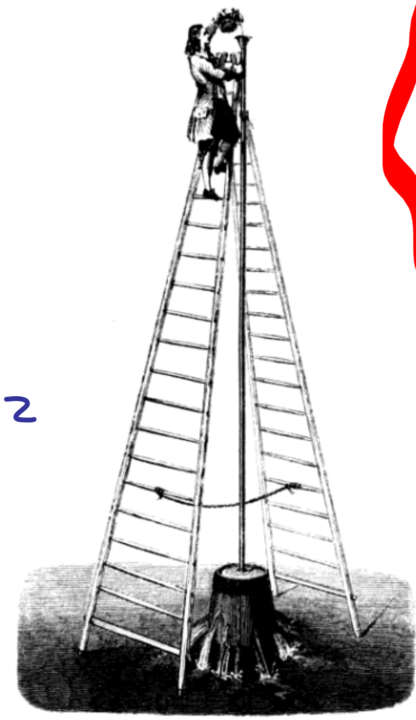
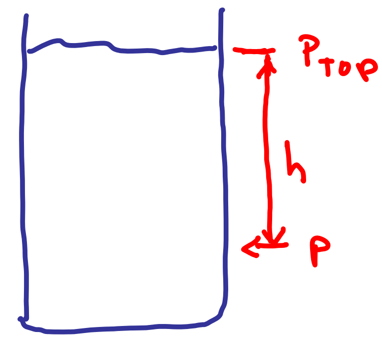


Fig. 45.—Hydrostatic paradox. Pascal's experiment.

$$P - P_{TOP} = \Delta P = \rho g h$$

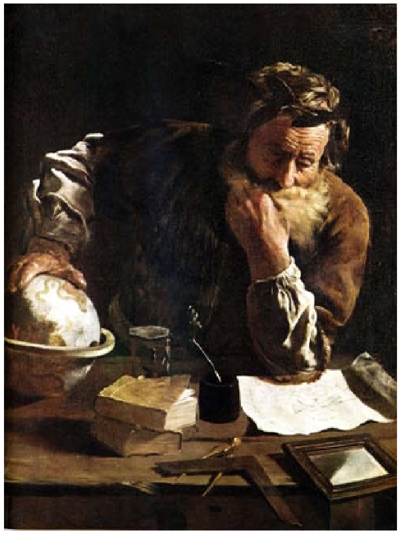
$$P = P_0 + \rho g h$$

pressure of gas on top



Pressure applied to an enclosed fluid is transmitted undiminished to every point in the fluid and the container walls.

It's the height, not the weight!



Archimedes

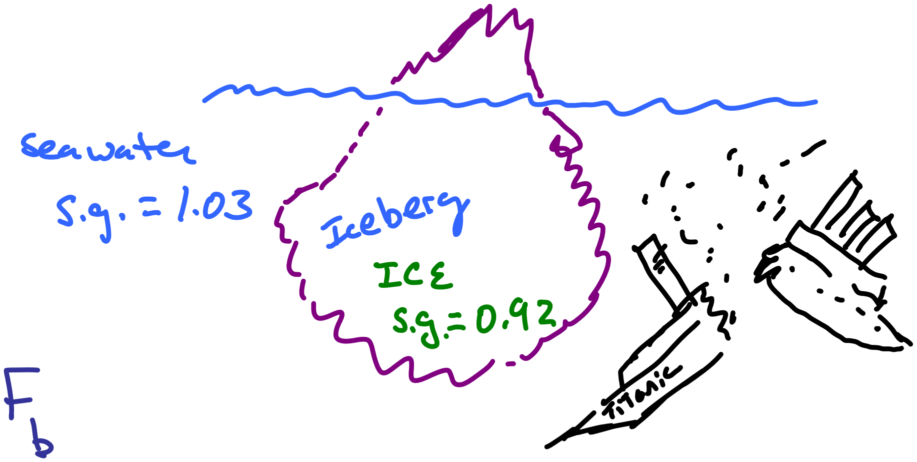
Syracuse, Sicily (Greek at the time)

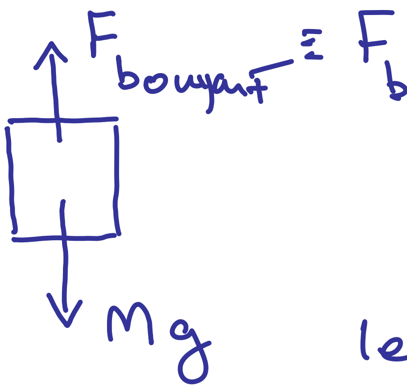
287 - 212 BC

Archimede's Principle

When a body is partially or completely submerged in a fluid, the fluid exerts an upward force (Bouyancy) on the body that is equal to the weight of the displaced fluid.

What fraction of the iceberg is submerged?





F_b = wt of displaced fluid

let $V \equiv$ volume of iceberg

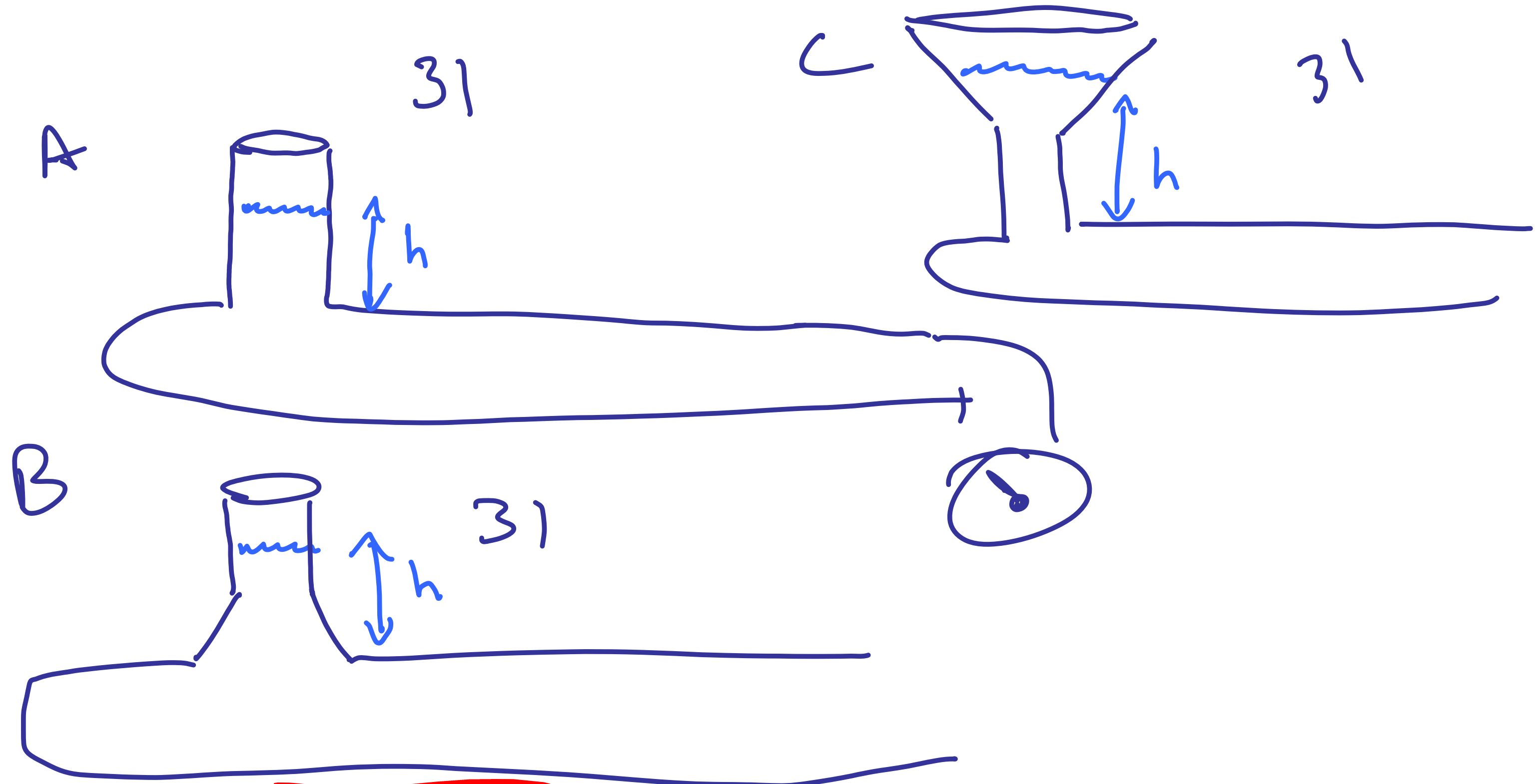
fraction submerged $\equiv x$

$$Mg = \rho_{ice} V g = F_b = (\rho_{seawater} \underbrace{x V}_{\text{volume submerged}}) g$$

$\div$ both sides by $\rho_{H_2O \text{ at } 4^\circ}$

$$(S.g._{ice}) V g = (S.g._{seawater}) x V g$$

$$\frac{Sg_{ice}}{Sg_{seawater}} = x = .92/1.03 = 89\%$$

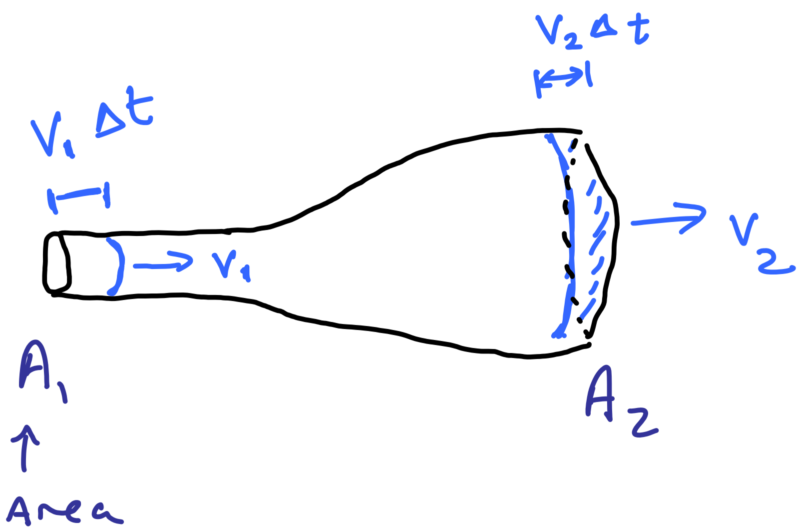


End of material for exam 3

Fluid dynamics — Hydrodynamics

ideal fluid → No viscosity
internal friction

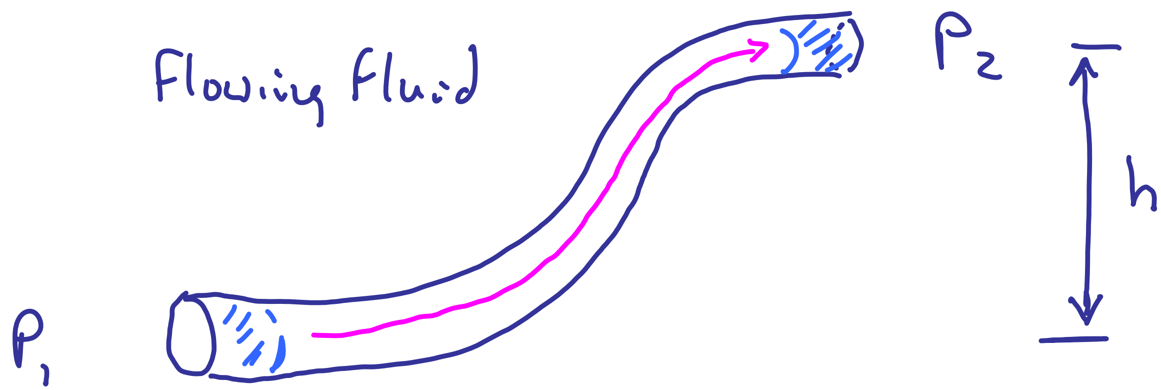
→ incompressible



Equation of Continuity

$$\underbrace{A_1 V_1 \Delta t}_{\text{Volume fluid flowing in at the left}} = A_2 V_2 \Delta t$$

$$A_1 V_1 = A_2 V_2$$



Energy conservation

For some element of fluid

$$W + \frac{1}{2}mv^2 + mgh \sim \text{constant}$$

$$\frac{F\cdot d}{V} + \frac{1}{2}\frac{mv^2}{V} + \frac{mgh}{V}$$

$V \equiv$ vol of this fluid element

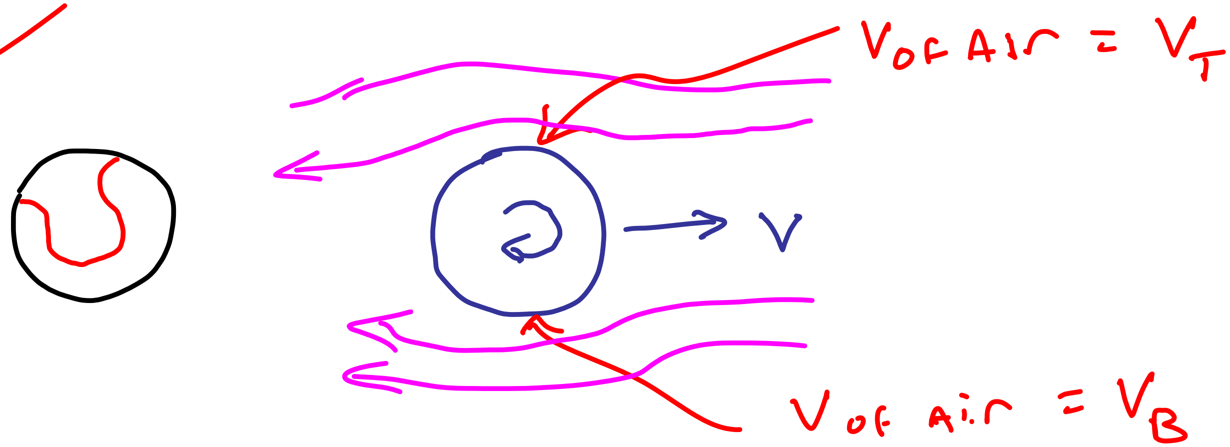
$$V \equiv A\cdot d$$

Bernoulli's Equation

$$\frac{F\cdot\cancel{d}}{A\cdot\cancel{d}} + \frac{1}{2}\frac{mv^2}{V} + \frac{mgh}{V} \sim \text{Constant}$$

Pressure $\qquad \rho \qquad \rho$

$$\boxed{P + \frac{1}{2}\rho v^2 + \rho g h = \text{Constant}}$$



$$\left(P_T + \frac{1}{2}\rho V_T^2 + \cancel{\rho g h}\right)_{Top} = \left(P_B + \frac{1}{2}\rho V_B^2 + \cancel{\rho g h}\right)_{BOTT}$$

$$P_T + \frac{1}{2}\rho V_T^2 = P_B + \frac{1}{2}\rho V_B^2$$

$$V_T < V_B \implies P_T > P_B$$

Airfoil